

## **EXHIBIT A**

### **Vapor Leak and Flammability Test Results for '868 Patent**

ASHRAE Standard 34 is an industry procedure for Designation and Safety Classification of Refrigerants, including the evaluation of refrigerant mixtures containing flammable components to determine if the refrigerants meet requirements for nonflammability. In some cases, refrigerant compositions may not be flammable as formulated, but could become flammable during vapor leakage from storage tanks or refrigeration and air conditioning systems. Addendum p of ASHRAE Standard 34-2004 provides guidance for a range of temperatures and refrigerant filling levels of storage tanks and equipment that must be evaluated to identify the worst case of refrigerant composition in terms of possible flammability. The required scenarios were evaluated for several compositions described in the '868 patent, shown in the attached table "Vapor Leak Test Data and Flammability Test Results for US 6,606,868 Compositions". The table has the starting compositions, and compositions that were measured after several levels of vapor leakage.

ASHRAE Standard 34-2004, addendum p, and ASTM E681 provide descriptions of apparatus and procedures for flame testing of refrigerant mixtures. The procedures are followed by lab personnel in the DuPont Fluorochemicals Laboratory in Wilmington, DE. Several of the refrigerants determined as worst case of composition in terms of possible flammability were tested in the flame test apparatus and determined to be flammable (see the table in Exhibit C). Other mixtures described as worst case for possible flammability were also determined to be flammable, by comparison with the flame test results for compositions of refrigerants designated as 1, 3, 4, and 9, or by reference to the flame boundary plot for mixtures of R125, R134a, and C3-C5 hydrocarbons. The flame boundary plot was developed from experimental data measured in the DuPont Fluorochemicals Laboratory following the ASHRAE and ASTM procedures.

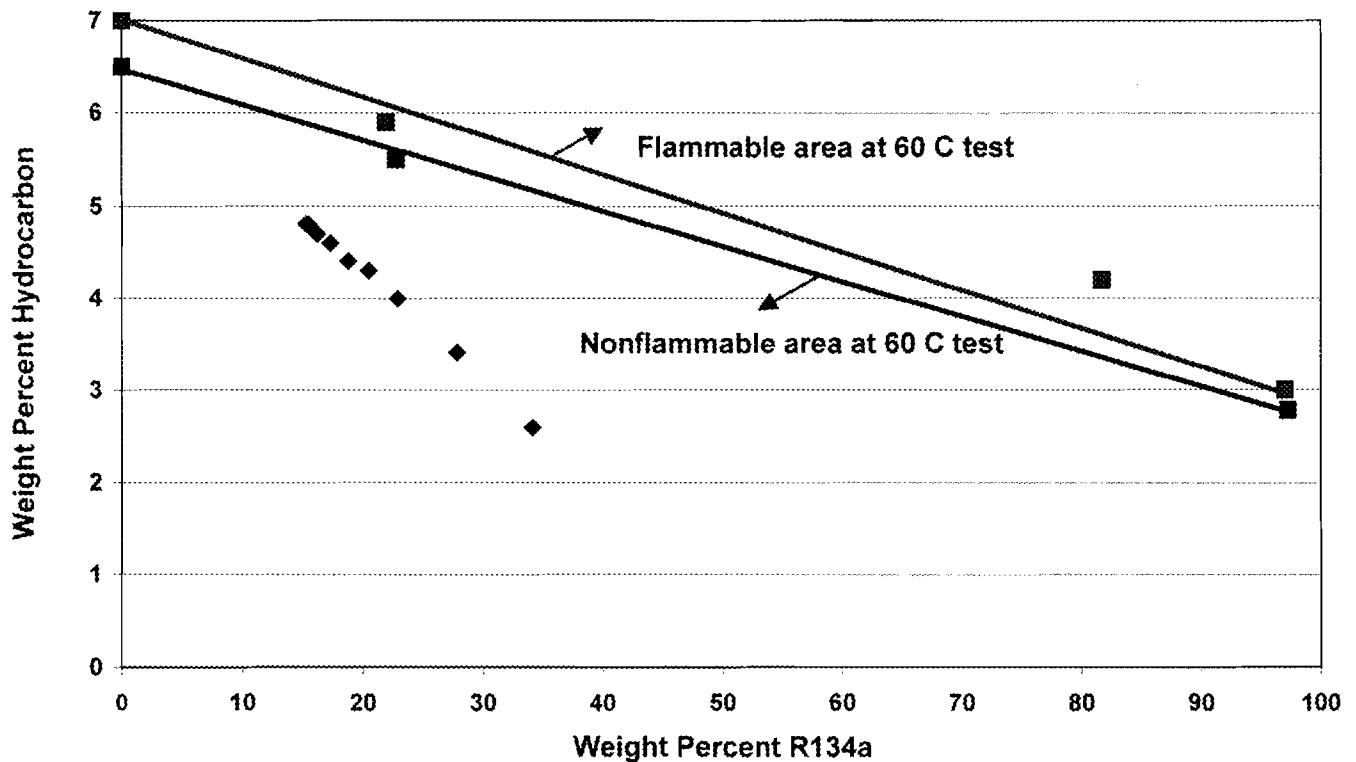
**BIVENS**  
**182**

Vapor Leak Test Data and Flammability Test Results for US 6.606.868 Compositions													
Test procedures per ASHRAE Standard 34-2004, addendum p and ASTM E681													
All of the refrigerants would be classified as flammable per Standard 34 requirements													
Any refrigerant having a lower and upper flame limit with the ASTM E681 test is classified as flammable													
The bolded numbers are those compositions selected as most flammable													
Refrigerant Designation	Vapor Leak Temp., C	Composition	Original wt%		after 50% leak		after 70% leak		after 90% leak		flame test results		
			liquid	vapor	liquid	vapor	liquid	vapor	liquid	vapor	% refrigerant in air	LFL	UFL
1	23	R125	72.2	82.3	53.6	78.4						8.5	16
		R134a	23.6	16.1	29.6	20							
		n-pentane	4.3	1.6	6.8	1.6							
2	23	R125	61.2	73.9	52.3	70							
		R134a	34.8	24.5	41.3	28.2							
		n-pentane	4.1	1.6	6.4	1.8							
3	23	R125	72.9	83.4	65.7	79.3						11	11.5
		R134a	23.1	15.4	28.3	19.3							
		cyclopentane	4.0	1.2	6.1	1.5							
4	23	R125	72.9	84.1	65.1	79.3						9	14.5
		R134a	23	14.4	28.5	18.6							
		isopentane	4.1	1.5	6.4	2.1							
5	23	R125	61.9	73.6					30.1	44.2	flammable by comparison with 9		
		R134a	35.1	24.1					64.2	52.1	and with flame plot		
		n-butane	2.0	1.9					2	2.1			
		n-pentane	1.0	0.4					3.7	1.6			
6	23	R125	66.9	77.5					36.3	51	flammable by comparison with 9		
		R134a	30.1	20.3					57.6	45.2	and with flame plot		
		n-butane	2.0	1.8					2.3	2.2			
		n-pentane	1.0	0.4					3.8	1.6			
7	23	R125	61.4	75.8							flammable by comparison with 1		
		R134a	35.7	23.0			44.2	60.4					
		n-pentane	3.0	1.2			48.9	36.9					
							7.0	2.7					
8	23	R125	66.1	78.1							flammable by comparison with 1		
		R134a	30.7	20.6			49.8	67.7					
		n-pentane	3.2	1.3			43.1	30.3					
							7.1	2.0					
9	-33	R125	64	78.6	40	66.9	26.7	59.3				8.5	15
		R134a	34	20.6	56	31.7	68.1	38.6					
		mpentane	2	0.8	4	1.4	5.2	2.1					

Ex A - BIVENS

282

### Flame Boundaries for R125/R134a/Hydrocarbon Refrigerant Mixtures



This plot of flame boundaries for refrigerant mixtures of R125, R134a, and C3-C5 hydrocarbons was developed from testing of refrigerant mixtures using the procedures for flame testing prescribed by ASHRAE Standard 34-2004, addendum p, and ASTM E681. The area between the flammable and nonflammable lines represents the area of uncertainty, and mixture compositions falling into this area would need to be tested for flammability. Note that R125 is not shown on the plot, as only the hydrocarbon and R134a content are necessary to fully characterize the mixture (the R125 content is simply the remaining amount).

The data for the flame boundary plot were determined by DuPont using the ASHRAE and ASTM procedures described above, over many years, including tests conducted after 2003. This chart was not made available to the public by DuPont until about June 2006.

**BIVENS**  
**EX.A**  
**583**